FINAL REPORT

FIELD RECONNAISSANCE AND WETLAND ASSESSMENT OF THE LEEDS SILVER SITE LEEDS, UTAH

JULY 1992

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1.0 INTRODUCTION

1.1 Site Background

The Leeds Silver Site is located approximately one mile northwest of Leeds, Washington County, Utah, in the Silver Reef Mining District (Figure 1). The site is an inoperative ore processing facility which utilized an acid heap leach process for the extraction of copper and silver. A few rural residences are located to the east and south of the site and plans have been made for a residential development one-half mile south of the site.

Limited sampling has been conducted at the site by the Utah Department of Environmental Quality (DEQ) Division of Environmental Response and Remediation in 1991.[1] This was conducted as part of a screening investigation to gather data for the purpose of scoring the site under the Hazard Ranking System. Results indicate that an ore stockpile in the northern portion of the site contains elevated concentrations of metals, most notably, mercury at 93.7 milligrams per kilogram (mg/kg). Copper (2080 mg/kg), selenium (16.8 mg/kg), silver (61 mg/kg), and vanadium (263 mg/kg) were also present in elevated concentrations. The two ponds associated with the acid leach process contain elevated concentrations of metals and are highly acidic. Cadmium (0.281 milligrams per liter [mg/l]), copper (883 mg/l), selenium (0.81 mg/l), silver (14.1 mg/l), and zinc (205 mg/l) were detected in the solution collected from the ponds, and the pH was 2.6 units.

1.2 Objectives

The objective of the field reconnaissance was to conduct an abbreviated wetland determination and to identify potential ecological concerns related to the site. The purpose of this report is to describe the wetlands and other ecological receptors observed during the field reconnaissance.

1.3 Regulatory Framework

At the Federal level, four agencies are involved with freshwater wetlands identification and delineation, including the United States (U.S.) Army Corps of Engineers (Corps), the U.S. Environmental Protection Agency (EPA), the U.S. Fish and Wildlife Service (FWS), and the U.S. Soil Conservation Service (SCS).

In the state of Utah, jurisdictional determinations of freshwater wetlands regulated under Section 404 of the Clean Water Act of 1975 are made by the Corps and the

EPA. Under authority of the U.S. Fish and Wildlife Coordination Act, the FWS review applications for the permits and provide comments to the Corps on the environmental impacts of proposed work.

In response to concerns that the Federal government establish a unified approach to the identification and delineation of wetlands, the EPA, the Corps, the FWS, and the SCS reached agreement on the technical criteria for identifying and delineating wetlands and agreed to merge existing methods into a single unified approach. On January 10, 1989 a single manual was adopted as the recommended methodology for identifying and delineating wetlands.[2] However, use of the 1989 manual resulted in the regulation of areas not previously considered to be wetlands; particularly areas where construction activities have, unintentionally, created conditions which meet the manual's criteria for a wetland. Comments are currently under review for modification of the wetland delineation manual and it is anticipated that changes will be made to existing procedures.

2.0 METHODOLOGY

To gain a better understanding of site conditions, the following resources were consulted prior to the field reconnaissance: U.S. Geological Survey topographic maps (Signal Peak, Pintura, Harrisburg Junction, and Hurricane quadrangles), the SCS Soil Survey of Washington County Area[3], and site maps and data obtained from the Utah DEQ.[1]

The field team consisted of Mark Sprenger Environmental Protection Agency (EPA), Environmental Response Team Work Assignment Manager (ERT/WAM), Pete Stevenson, EPA On Scene Coordinator (OSC), Wayne Thomas, Utah DEQ District Engineer, Jasen Knowlton, Utah DEQ, Division of Environmental Response, and Richard Henry, Response Engineering Analytical Contract (REAC) Task Leader. The field team arrived on-site at approximately 1015 hours on May 6, 1992. The OSC conducted a briefing detailing site history and investigative results and a site orientation highlighting the location of specific activities. This was followed by a site reconnaissance during which various site and natural features were examined and photodocumented. In particular, potential contaminant migration pathways and ecological receptors were evaluated. The field team departed the site at approximately 1300 hours.

Wetlands were identified using the three parameter approach of the 1989 Federal Interagency Manual for Identifying and Delineating Jurisdictional Wetlands.[2] This approach identifies wetlands based on the presence of the following criteria: (1) a periodic predominance of hydrophytic vegetation, (2) a substrate of predominantly undrained hydric soil and (3) a substrate saturated or inundated during part of the growing season (i.e., the appropriate wetland hydrology). A qualitative assessment was made of vegetative communities by noting the distribution and extent of dominant plant species by direct observation. Soil was sampled to determine the extent of saturation and flooding that may potentially result in hydric conditions. Soil profiles obtained by tube auger were investigated visually for color, organic content, general texture, mottling or streaking, and evidence of past disturbance. Given the highly disturbed and potentially contaminated nature of on-site soils, soil sampling was relied upon to a lesser extent than typical. A Munsell[4] color chart was used to qualify and record soil color. In general, low chroma (a dark or grayish color) along with the presence of mottling, is often a strong indicator of the reducing conditions present in saturated soils. The presence of hydrologic indicators including topographic and surface water features, soil saturation and evidence of past inundation or surface flow, tree buttressing, watermarks, darkened leaves, sediment deposition and/or driftlines were noted.

3.0 RESULTS AND DISCUSSION

The site is located in a narrow, steep walled valley formed by Buckeye Reef to the southwest and White Reef to the northwest (Figure 2). Surface elevations range from approximately 3,640 feet at the northern extent of the site to approximately 3,520 feet at the southern extent. The main feature of the site is a centrally located pile of crushed ore underlain by an asphalt pad (Photo 1, background). This pad is oval in shape with a north-south orientation and slopes downward to the south. The asphalt pad covers an area of approximately 3.8 acres and, in conjunction with the ore, is referred to as a heap leach pad.[1] The leach pad is flanked to the south by a small collection pond, also referred to as the "pregnant pond", or "acidic water collection pond", (Photo 1, foreground) and south of this is an overflow pond, also referred to as "overflow reservoir" or "asphalt lined overflow pond", (Photo 2). The overflow pond is situated slightly downgradient of the collection pond and presumably designed to intercept and contain excess solution should the capacity of the collection pond be exceeded. Collectively, the ponds cover an area of approximately 0.9 acres and are also underlain by asphalt. A network of perforated polyvinyl chloride pipe traverse the surface of the ore pile and are used to distribute an acidic solution across the surface of the pile. As the acid solution percolates through the pile, it leaches metals from ore it comes in contact with. The metal bearing solution flows downslope along the pad and ultimately drains into the collection pond. The solution is pumped from the pond and silver, as well as other metals are recovered. At the time of the investigation, both ponds were partially full. The solution in the collection pond was clear but slightly green in color and the perimeter of the pond was ringed by a bright yellow precipitate (Photo 3). The solution in the overflow pond was similar in appearance to that in the collection pond, however a yellow precipitate was not observed.

North of the leach pad is a 1.3 acre ore stockpile and south of this stockpile, about half the distance to the leach pad, are several electrical transformers. An ore mill area covering 0.5 acres is present in the southwest corner of the site (Photo 4). Several electrical transformers are also present in the mill area. A warehouse and test area, also associated with on-site operations, are located approximately 1,000 feet northwest of the processing area. This warehouse also contains several transformers.

South of the overflow pond, the valley becomes increasingly constricted between White and Buckeye Reefs. At the south end of the valley, the natural drainage is blocked by a dirt road, rubble associated with the California Mine, and an earthen levee (Photo 5). It appears that these features may contain most of the surface drainage from the site. Further, this configuration creates a basin that is referred to in-site documentation as a "secondary surface water impoundment", the "unlined secondary impoundment", or "storage ponds" that would contain runoff from the site should the ponds overflow.[1] A canal flows along Buckeye Reef and drains into the basin immediately south of the overflow pond (Photo 6). Within the basin, the canal is well defined and is approximately 18 inches in width and has a maximum depth of approximately eight inches (Photo 7). In the northern portion of the basin, the channel flows along the western levee and is situated somewhat higher in elevation than the basin floor. At the southern end of the basin, the canal drains into a partially filled mine shaft. South of the valley, the surface water flow drains into a pond utilized for irrigation supply and livestock watering (Photo 8). Depressional areas within the basin contained standing water and the soils were saturated at the surface (Photo 9). This appears to result from subsurface lateral seepage from the canal, as well as periodic overflow of the canal during storm events.

The site itself consists of a narrow valley surrounded by steep hillsides and, as a result, contains various microclimates and microconditions that support different vegetative communities. Abiotic factors influencing vegetative community composition include slope angle and orientation, soil type and fertility, and depth to groundwater. Together, these factors influence the available soil moisture, nutrients, and air temperature, which in turn dictate the resulting plant community composition. The vegetation present at any one spot depends largely on the position in the environmental continuum as graded from the dry upper valley floor and Reef walls to the moist lower valley floor. Along the Reef walls and upper valley floor, saltbush (<u>Atriplex canescens</u>), rabbitbush (<u>Chrysothamnus</u> sp.), brittlebush (Encelia sp.), scarlet mallow (Sphaeraleca coccinea), milk vetch (Astragalus sp.), antelope brush (Purshia tridenta), creosotebush (Larrea tridentata), blackbush (Coleogyne ramosissima), Mormon tea (Ephedra sp.), sage (Ambrosia sp.) and cactus (Opuntia sp. and Ferocactus sp.) were common (Photo 10). These species are typical desert plants adapted to an arid environment[5]. At the opposite end of the continuum, a wetland vegetative community is present (Photos 11 and 12). This community is dominated by rushes (Juncus spp.) and sedges (Carex spp.) with fewer numbers of fremont cottonwood (Populus fremontii), willow (Salix niger cf.), Tamarix (Tamarix sp.), and cattail (Typha sp.) were present as well.

The site has been mapped by the SCS as part of the rock outcrop-rock land association.[3] This association is present on gently sloping to very steep desert basins and on uplands and consists of bare bedrock, and very shallow soils over bedrock. The rock outcrop-rock land association is typically found at elevations ranging from 2,600 feet to 7,000 feet. The Leeds Silver Site is mapped as the rock outcrop unit (Figure 3). This mapping unit consists of bare bedrock exposures comprised of mostly sandstone, limestone, conglomerate, or basalt. Field investigation confirmed the presence of rock outcrop throughout most of the site. However, the soil in the wetland basin south of the collection and overflow ponds are not consistent with the description of the mapping unit. Within the basin the soils consist of a 6 to 14 inch layer of yellowish red to reddish brown fine sandy clay loam over dark gray sandy clay loam. A hardpan is present at 18 to 24 inches below the soil and consists of a reddish brown prismatic material. This relatively impervious layer could account for the saturated soil conditions observed throughout the basin.

The mapping performed by the SCS is based on aerial photography at a scale of 1:20,000 which prohibits the identification of small nontypical inclusions located within larger mapping units. Although the soil observed in the basin may represent an inclusion of an associated soil type, field observations suggests that this material was formed under different conditions and/or derived from a different parent material. The area north of the site is mapped as Veyo-Curhollow soils. The Veyo soils consist of brown cobbly sandy loam underlain by brown cobbly clay loam, yellowish-red and reddish-brown very cobbly clay and brown very cobbly sandy clay loam. The Curhollow soils consist of brown gravelly fine sandy loam overlaying light-brown gravelly loam and very gravelly fine sandy loam. The erosion hazard of this complex is moderate and the slopes range from 3 to 10 percent. The canal that drains Leeds Creek flows through the Veyo-Curhollow mapping unit and soil eroded from adjacent areas are likely to enter this watercourse. Subsequent downstream transport and deposition in the wetland basin may account for the characteristics of the surface soil observed.

In the southern portion of the site, hydrology has been substantially influenced by past activity. Surface water, diverted from Leeds Creek, flows into a constricted portion of the valley where drainage has been blocked by historic site activities. Subsurface seepage and overflow from the canal, as well as the presence of an impervious hardpan layer have resulted in a high degree of soil saturation within the basin. With the exception of the collection and overflow ponds, the canal is the dominant hydrologic feature on the site, and forms the central core of a wetland plant community that has developed within the basin. This area presently supports a significant amount of obligate and facultative wetland hydrophytic species; although appearing quite natural in its present state, this vegetative community may very well exist as a result of the altered drainage and hydrology. In contrast, vegetation occurring throughout the rest of the site and in the vicinity of the site is typical of arid regions. The mapping performed by the SCS was based on aerial photography at a scale of 1:20,000. This prohibits the mapping of small inclusions located within larger nonhydric mapping units. Although recognized as a wet spot on the soil map, the area has been mapped within a larger upland unit. Nevertheless, the soil examined was saturated to the surface and, due to the presence of the fragipan and the diverted water, is likely to remain saturated for greater than one week during the growing season.

The highly disturbed nature of soils on site, particularly in the southern basin, provided sufficient justification to rely on vegetation and hydrological characteristics to a greater extent than soils in making this wetland determination. However, the presence of significant hydrologic indicators and facultative wetland species was sufficient evidence to classify the basin south of the collection and overflow ponds as wetlands using the 1989 Federal interagency methodology. The approximate extent of the Leeds Silver Site that possess the three criteria necessary to meet this regulatory definition of a wetland are mapped on Figure 2.

The concentration of most metals detected in water and sediment collected from the ponds and wetland basin were substantially greater than the upstream reference. In particular, aluminum (25,200 mg/kg), arsenic (13.6 mg/kg), and copper (1680 mg/kg) were more than an order of magnitude greater in wetland sediment than in reference sediment. Further, the concentration of antimony (0.156 mg/l), aluminum (9.5 mg/l), cadmium (0.821 mg/l), chromium (0.082 mg/l), copper (883 mg/l), iron (12 mg/l), manganese (165 mg/l), mercury (0.005 mg/l), nickel (1.05 mg/l), selenium (0.81 mg/l), and zinc (205 mg/l) in the collection and overflow ponds were in excess of water quality criteria or concentrations that typically result in biological impairment. As suggested by the sediment concentrations, it is likely that these ponds have discharged their contents to the wetland basin during the operational or storm induced high flow events.

The site is located in the northeast portion of the Mojave desert and the vast majority of site and adjacent area is typical of that ecotype. In contrast, the wetland represents unique habitat that potentially supplies critical habitat elements that are limited in areas adjacent to the site. In particular, open water appears to be readily available in the wetland whereas the surrounding area is relatively arid with low water availability. Moreover, evidence of habitat utilization including sittings of several species, finches, warblers, raptors, deer and small mammal signs, and a toad were observed. Hence, organisms are potentially exposed to site contaminants.

A determination of potential ecological risk involves an appraisal of the site setting, contaminants and contaminant behavior, and probable receptors and potential effects. Although a formal collection of data to conduct an environmental risk evaluation was not conducted; a qualitative evaluation can be made from the existing data. Based upon the observations made during this site evaluation, there are complete and potentially important exposure pathways to environmental receptors. Additionally, based upon previously collected data there are contaminants present at the site which potentially could result in an unacceptable exposure to existing environmental receptors.

4.0 CONCLUSIONS

1) An emergent wetland was identified on the Leeds Silver Site. This wetland is unique to the surrounding ecotype and appears to be utilized by wildlife.

2) As a result of stream diversion (from Leeds Creek) and flow restriction in the southern portion of the site, the wetland appears to be wholly or partially man induced.

3) Given the elevated concentrations of some elements in sediment and water collected from the wetland basin, the collection pond, and the overflow pond, as well as the high probability of utilization of the site by endemic biota, the site potentially represents a substantial ecological risk.

5.0 RECOMMENDATIONS

If any actions are to be taken at the Leeds Site a formal wetland delineation should be conducted. Additionally, a functional assessment of the existing wetlands would be needed if the wetlands are to be disturbed.

Since it appears that contaminants have historically been transported into the wetlands and that the potential for additional release of potentially hazardous levels of contaminants exists; as well as the uncertainty associated with future site stabilization, it would be prudent to further characterize the potential for environmental threat, so that the need for immediate action can be properly evaluated.

REFERENCES

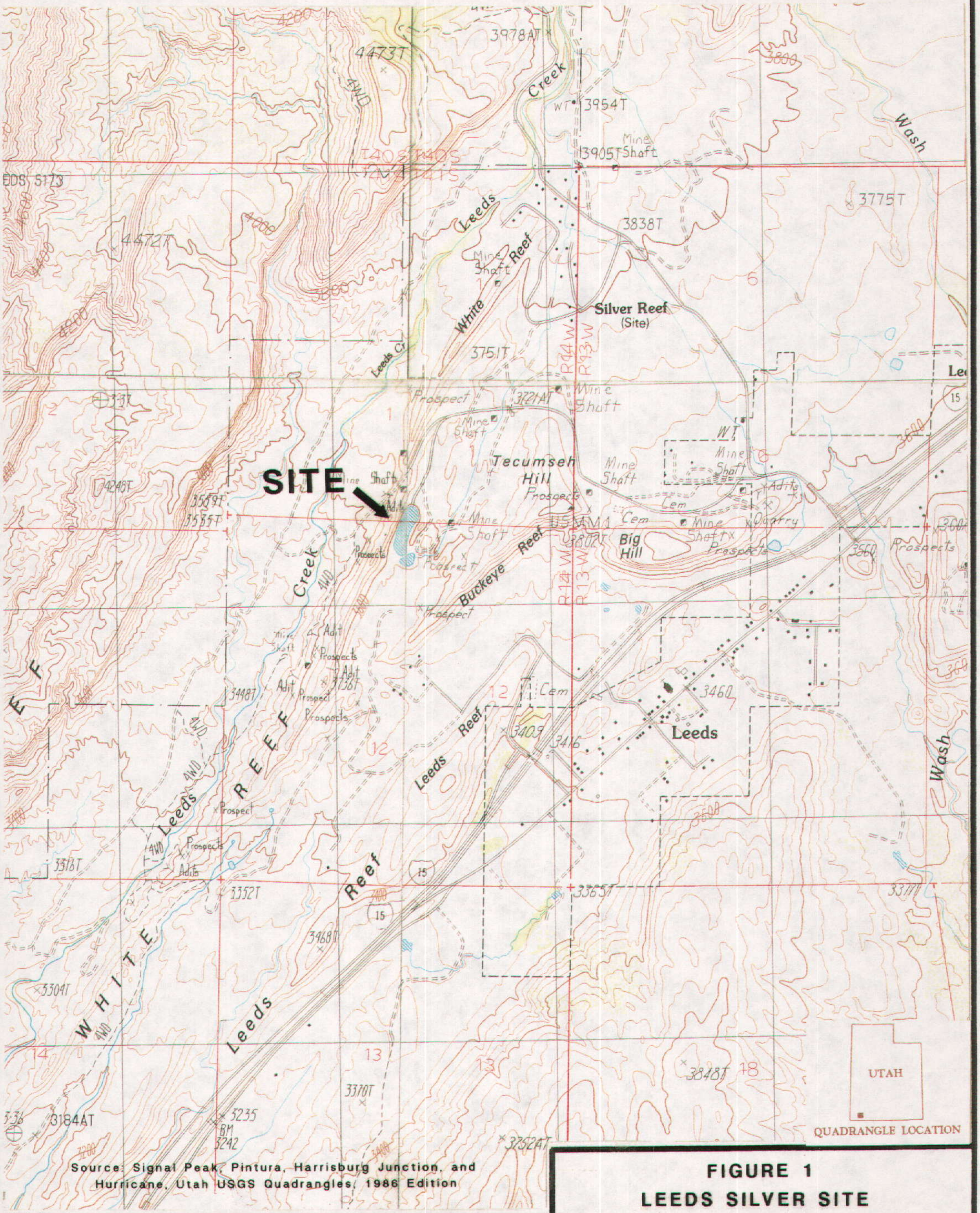
(1) Knowlton, J.L., 1991, Analytical Results Report, Leeds Silver Reclamation Site, Washington County, Utah, Utah DEQ, Division of Response and Remediation, UTD981550619.

(2) Federal Interagency Committee for Wetland Delineation. 1989. Federal Manual for Identifying and Delineating Jurisdictional Wetlands. US Army Corps of Engineers, US Environmental Protection Agency, US Fish & Wildlife Service, and USDA Soil Conservation Service, Washington, DC. Cooperative technical publication.

(3) U.S. Department of Agriculture, Soil Conservation Service, the Department of Interior, the Bureau of Land Management, and the National Park Service, Soil Survey of Washington County Area, Utah.

(4) Munsell Color, 1975, Munsell Soil Color Charts, Kollmorgen Corporation, Baltimore, MD.

(5) Benson, L. and R.A. Darrow, 1981, Trees and Shrubs of the Southwestern Deserts, The University of Arizona Press, Tuscon Arizona, 416 pp.

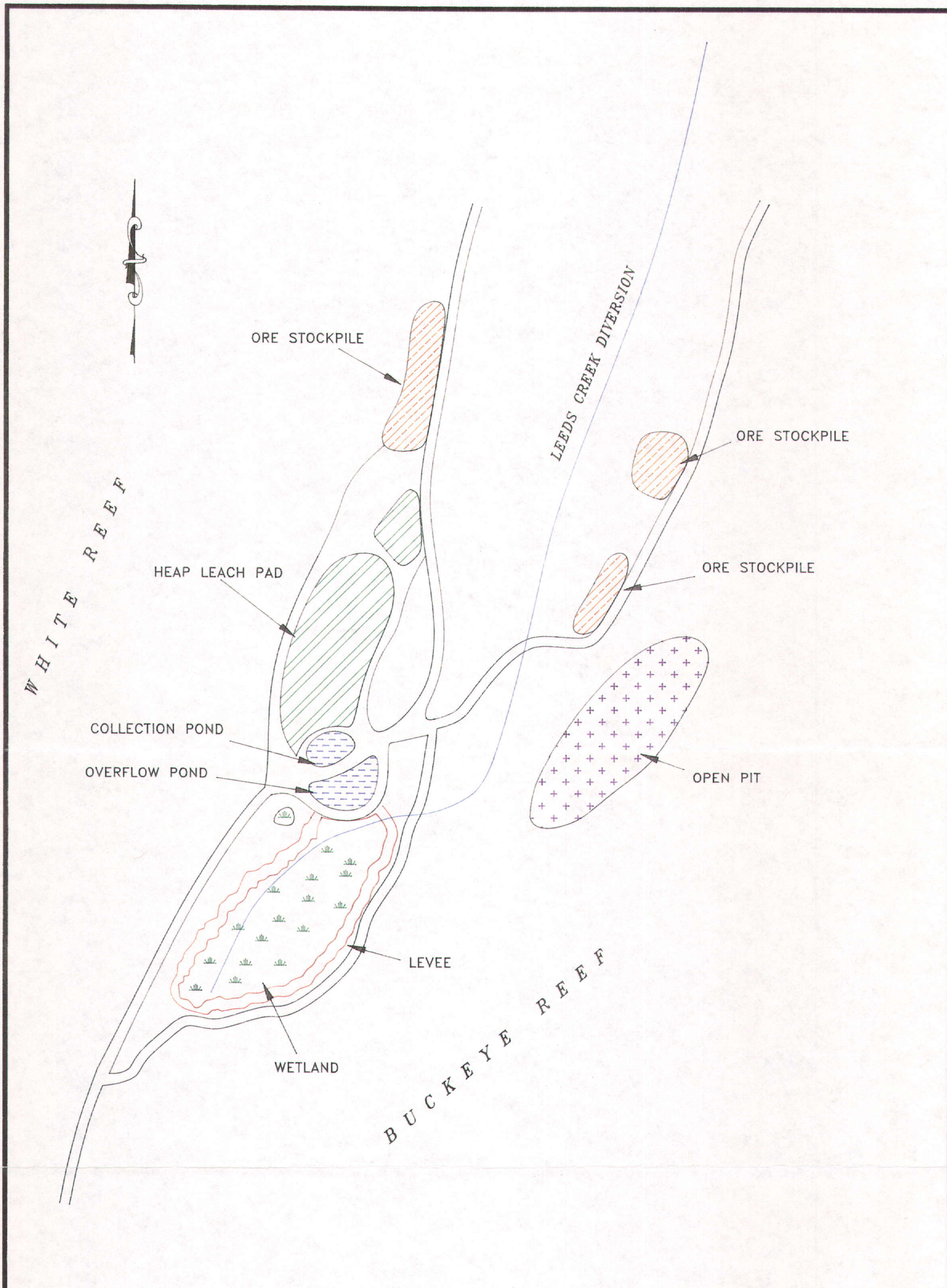


Source: Signal Peak, Pintura, Harrisburg Junction, and Hurricane, Utah USGS Quadrangles, 1986 Edition

FIGURE 1
LEEDS SILVER SITE
LEEDS, UTAH

US EPA ENVIRONMENTAL RESPONSE TEAM
RESPONSE ENGINEERING AND ANALYTICAL CONTRACT
68–03–3482

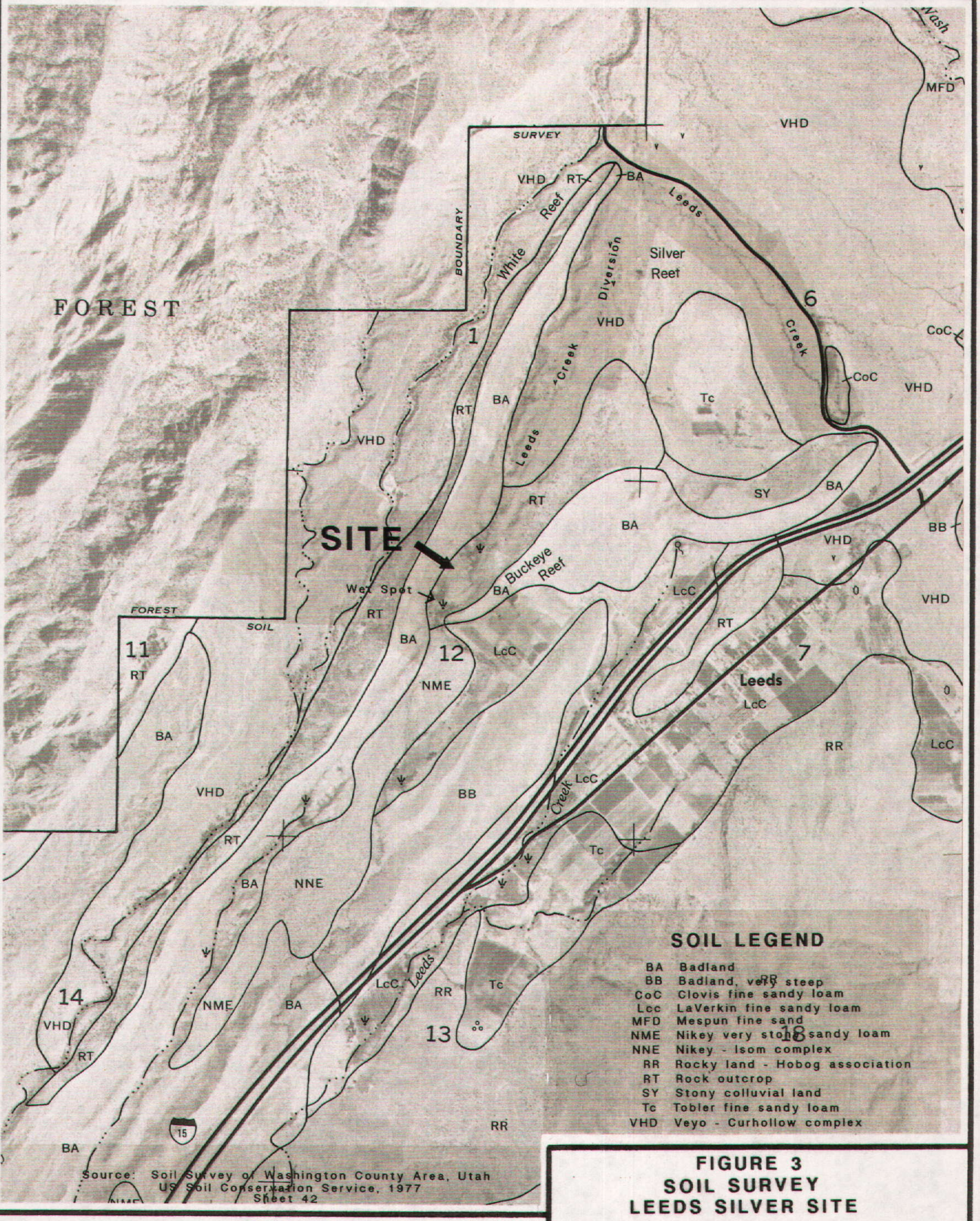
3347-31-01-4633	MAY 1992



NOT TO SCALE

FIGURE 2
SITE MAP
LEEDS SILVER SITE
LEEDS, UTAH
MAY 5, 1992

US EPA ENVIRONMENTAL RESPONSE TEAM
RESPONSE ENGINEERING AND ANALYTICAL CONTRACT
68-03-3482
W.O.# 3347-31-01-4633



US EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT
68-03-3482

FIGURE 3
SOIL SURVEY
LEEDS SILVER SITE
LEEDS, UTAH

3347-31-01-4633 | MAY 1992

APPENDIX A

SITE PHOTOGRAPHS

FIELD RECONNAISSANCE AND
WETLAND ASSESSMENT OF THE
LEEDS SILVER SITE
LEEDS, UTAH

US EPA ENVIRONMENTAL RESPONSE TEAM RESPONSE ENGINEERING AND ANALYTICAL CONTRACT 68-03-3482	PHOTO 1 LEEDS SILVER SITE	
	3347-31-01-4633	MAY 1992

US EPA ENVIRONMENTAL RESPONSE TEAM RESPONSE ENGINEERING AND ANALYTICAL CONTRACT 68-03-3482	PHOTO 2 LEEDS SILVER SITE	
	3347-31-01-4633	MAY 1992

US EPA ENVIRONMENTAL RESPONSE TEAM
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68-03-3482

PHOTO 3 LEEDS SILVER SITE
3347-31-01-4633 MAY 1992

US EPA ENVIRONMENTAL RESPONSE TEAM
RESPONSE ENGINEERING AND ANALYTICAL CONTRACT
68-03-3482

PHOTO 4 LEEDS SILVER SITE
3347-31-01-4633 MAY 1992

US EPA ENVIRONMENTAL RESPONSE TEAM RESPONSE ENGINEERING AND ANALYTICAL CONTRACT 68-03-3482	PHOTO 5 LEEDS SILVER SITE	
	3347-31-01-4633	MAY 1992

US EPA ENVIRONMENTAL RESPONSE TEAM RESPONSE ENGINEERING AND ANALYTICAL CONTRACT 68-03-3482	PHOTO 6 LEEDS SILVER SITE	
	3347-31-01-4633	MAY 1992

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PHOTO 7 LEEDS SILVER SITE

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PHOTO 8 LEEDS SILVER SITE

3347-31-01-4633 MAY 1992

US EPA ENVIRONMENTAL RESPONSE TEAM RESPONSE ENGINEERING AND ANALYTICAL CONTRACT 68-03-3482	PHOTO 9 LEEDS SILVER SITE	
	3347-31-01-4633	MAY 1992

US EPA ENVIRONMENTAL RESPONSE TEAM RESPONSE ENGINEERING AND ANALYTICAL CONTRACT 68-03-3482	PHOTO 10 LEEDS SILVER SITE	
	3347-31-01-4633	MAY 1992

US EPA ENVIRONMENTAL RESPONSE TEAM RESPONSE ENGINEERING AND ANALYTICAL CONTRACT 68-03-3482	PHOTO 11 LEEDS SILVER SITE	
	3347-31-01-4633	MAY 1992

US EPA ENVIRONMENTAL RESPONSE TEAM RESPONSE ENGINEERING AND ANALYTICAL CONTRACT 68-03-3482	PHOTO 12 LEEDS SILVER SITE	
	3347-31-01-4633	MAY 1992